

in Berlin, then, for greater quiet, in the Astrophysicalisches Observatorium at Potsdam (it was very sensitive to vibrations). The interpretation of the results is that there is no displacement of the interference bands, and the hypothesis (which is presupposed in the commonly accepted explanation of aberration) is inferred to be erroneous.

THE expansion of solid sulphur has been studied by S. Scichilone of Palermo, in the case of natural crystals, and of such as had been heated after fusion to 140° and 240° . The tables (*Wied. Beibl.*, No. 7) show that the expansion depends essentially on the previous heating, inasmuch as different modifications of sulphur are thereby formed. In the first case we have the octahedral sulphur, in another the monoclinic, and in the third a mixture of the latter with that which is not dissolved in sulphide of carbon. In the first two cases the curve representing the volumes as a function of the temperature turns its convex side, in the third its concave side, to the axis of temperature.

GEOLOGICAL NOTES

THE recent geological exploration of the shores of Lake Baikal by M. Tchersky has been fruitful of important results for science. The rocks of which the mountains on the western shore are built up belong to three different ages: pre-Silurian (probably Laurentian), Silurian, and Jurassic. The Laurentian rocks afford several foldings running north-east, which enclosed basins of Silurian and Jurassic seas; as to recent formations they are only freshwater ones, and belong to the Tertiary and Post-pliocene; these last, which are remains of several smaller lakes, are found at a great height above the level of Lake Baikal. M. Tchersky's geological researches confirm the suggestion which was made several years ago on geographical grounds by M. Kropotkin, namely, that, like several other lakes, Lake Baikal consists of two longitudinal valleys, connected together in the middle part of the actual basin.

THE important coal-basin of the Don province of Russia has not hitherto been explored with accuracy. During last summer M. Domger undertook a thorough exploration of this interesting geological region, and, as we learn from a communication he has made at the December meeting of the St. Petersburg Mineralogical Society, his researches have led to important discoveries. Thus he discovered a great variety of crystalline rocks, porphyries, &c., and volcanic ores, within the coal-measures, which discovery thus extends the crystalline island of Southern Russia far eastwards as a strip about 500 miles long, which runs from north-west to south-east. At the same meeting the Society awarded its gold medal to M. Romanoffsky for his researches in Turkestan.

M. DOKOUCHAIEFF's researches on the soils of Russia seem to establish a very interesting fact as to the distribution of black-earth. The typical black-earth occupies an elongated zone directed from south-west to north-east from Kishineff, through Kharkoff, Voronezh, Simbirsk, to Bougoulina in the province of Oufa; in this zone the black-earth contains from 7 to 12 per cent. of humus, and from both sides to north-west and south-east it is accompanied by two other elongated zones, where the black-earth contains only 5 to 7 per cent. of humus, whilst the other parts of Russia afford only sporadic spots of black-earth.

M. MOUSHKETOFF's paper on the glacier of Zerafshan, which appeared in a recent number of the *Izvestia* of the Russian Geographical Society, contains further details about the expedition which has explored the glacier throughout its whole length, from its lower extremity to the sixteen miles distant and 13,800 feet high pass of Matcha, whence another glacier, that of the Zardala river, descends on the north-eastern slope for 2200 feet, by a series of mighty icefalls. The paper is accompanied with a pretty map which shows this grand ice-world, where no less than thirteen secondary glaciers are feeding the ice-stream of the Zerafshan. We notice in this paper that formerly the Zerafshan glacier descended far lower than now. M. Moushketoff says that thirty-three miles below its actual extremity, namely, at the village Diaminor, there is a beautiful terminal-moraine which crosses the valley and unites with three longitudinal moraines. Immense boulders, thirty-five and forty feet in diameter, and consisting of granite, syenite, and gabbro, cover the whole space between these old moraines and the actual ones, so that there cannot be the least doubt as to the glacier having descended

for at least thirty-three miles lower than now. But when we see how the composition of the drift changes lower down in the valley, the loess, which is the wealth of the inhabitants in the lower countries, changing into mighty conglomerates with immense boulders, we are much inclined to think, that the former glaciers descended yet far lower. Therefore we observe with some regret that M. Moushketoff gives too little attention to the diluvial formations of the Upper Zerafshan and to their relations to the loess.

GEOGRAPHICAL NOTES

WHEN Humboldt determined for the first time the average heights of continents, he could not, because of the want of data, determine that of Africa. Now Dr. Chavanne publishes, in the *Proceedings* of the Geographical Society of Vienna (vol. xxiv.), an elaborate paper on this subject, accompanied with a hypsometrical map of the African continent, which is based on no less than 8000 hypsometrical measurements. After a thorough discussion of the relative value of various measurements, Dr. Chavanne discusses the average heights of separate parts of Africa, and by how much each of them would raise the continent if its mass were distributed over the whole of the surface of Africa. He finds that the Atlas Mountains, if distributed over the surface of Africa, would produce an elevation of 26 metres; the Sahara, 122 metres; the plateaux of Soudan, 85 metres; those of Central and South Africa, 129 metres; and so on; and he accepts for the average height of the whole of the continent no less than 661.8 metres (with a probable error of ± 21 metres), which figure he considers to be rather below the truth. This very high figure obviously is the result of the very great extension of high plateaux, which we do not find to such an extent even in Asia.

IN the Annual Report of the Surveyor-General of India, which, though it has been printed for months, has only just been allowed to appear, prominence is given, under the heading of Trans-Frontier Exploration, to an attempt to determine the position of the head-waters of the Irrawaddy by Capt. J. E. Sandeman, through the agency of a native surveyor whom he had trained in imitation of the late Col. T. G. Montgomerie's renowned staff in India. This surveyor alleges that he ascended the river to Mogung-poon, near the point where it divides into two great branches, the Malee and Mehka. The surveyor, we believe, gives as an explanation of his not having prosecuted his journey to a more successful termination, that he was attacked and robbed by wild tribes; but we hear privately that persons in Burma, well qualified to form an opinion, attach little credit to any of the surveyor's statements, and we fear, therefore, that the position of the head-waters of the Irrawaddy is still an unsolved problem.

THE Geographical Society of the Pacific is the title of a new Society formed at San Francisco. The Secretary is C. Mitchell Grant, F.R.G.S. The objects of the Society, it is stated, are to encourage geographical exploration and discovery; to investigate and disseminate geographical information by discussion, lectures, and publications; to establish in the chief city of the Pacific States, for the benefit of commerce, navigation, and the industrial and material interests of the Pacific Slope, a place where the means will be afforded of obtaining accurate information, not only of the countries bordering on the Pacific Ocean, but of every part of the habitable globe; to accumulate a library of the best books on geography, history, and statistics; to make a collection of the most recent maps and charts, especially those which relate to the Pacific coasts, the islands of the Pacific, and the Pacific Ocean; and to enter into correspondence with scientific and learned societies whose objects include or sympathise with geography. The Society will publish a *Bulletin* and an annual *Journal*.

WE learn from the Annual Report for 1880-1881 of the Swiss correspondent of the Geographical Society of Vienna that the following geodetical and geological work was done in Switzerland:—The Geodetical Commission has published the seventh fascicule of the "Nivellement de Précision de la Suisse," which contains the measurements done during the years 1877 to 1879 on the lines of Monte Cenero to Chiasso, Reichenau to Sargans and Andermatt, and Süss to Landquart and Chiavenna, uniting thus the Swiss measurements with the Italian ones. The Geological Commission publishes the fourth volume of its new series, containing the important work, by Dr. Balzer,

on the zone of contact between the gneiss and the limestones of the Berne Oberland; another most interesting work, on the distribution of heat in the interior of the St. Gothard Tunnel, is pursued by Dr. Stapff, and a preliminary notice about it, with maps, has just appeared in the Quarterly Reports of the Federal Council. (vol. vii.). It shows that the temperature of rocks increases to a great degree to the interior of the tunnel, being only 17° Celsius and $19^{\circ}7$ at the southern and northern extremities of the tunnel, and as high as $30^{\circ}8$ in the middle parts of it, the decrease at the outer ends being attributed by Dr. Stapff to the cooling influence of the water which circulates in the rocks. As to the geological information collected by Dr. Stapff during his work in the tunnel, which appears complete (with sixty sheets of maps and profiles) in the Reports of the Federal Council, a short *résumé* of the whole has already appeared in a separate fascicule of these Reports, with a geological outline of the tunnel. We notice also in this branch a valuable paper, by M. Salis, on the erosion of the Nolla River, tributary of the Rhine, which has appeared in the engineering paper, *Die Eisenbahn*, published at Zurich.

THE various races which inhabit Austria are studied by Dr. Goehrlert in the last number of the *Proceedings* of the Geographical Society at Vienna (vol. xxiv.), with respect to the length of the body. After having collected more than one and a half million of such measurements, which were done on recruits during the years 1870 to 1873, Dr. Goehrlert has dressed a map in which he has shown the average height of young men, twenty to twenty-three years old, in Austria. The Dalmatians are the tallest; next to them come the Serbo-Croats and Slovenes, and then the Germans and the Czechs; further down come the Ruthenes and Roumanians, and the smaller ones are the Magyars and Poles, especially the Mazours. But there are also two or three distinct average heights among the Germans, the Slaves, and the Magyars, those of middle Hungary, between the Danube and the Theiss rivers, being far taller than those of the flat country on the left bank of the Theiss. It is most probable, as M. Broca has shown with regard to France, that these notable differences of height among the same race show that there were two, or more, different branches which constituted what we consider now as a single race. As to the supposed decrease of height observed in France, Dr. Goehrlert supposes that in Bohemia, which has furnished during this century no less than 600,000 men to the Austrian armies, the decrease of average height can be estimated at little under 39 millimetres during the last hundred years, this decrease being due to the continuous taking away of tall men from the country. He shows also that, the standard height being the same for all provinces of Austria, the provinces where men are taller suffer proportionately more from recruiting.

THE seventeenth meeting of the Swiss Alpine Club was opened at Basel on September 10. The Annual Report shows that since its foundation the Club has built thirty-one huts, or *refuges* for climbers. The Club has also endeavoured to give a certain instruction to guides, and during this year an insurance society has been instituted for them. As to its publications, it has published sixteen volumes of year-books, which contain plenty of valuable information on the Swiss Alps, and publishes two papers, the *Écho des Alpes* and the *Neue Alpenpost*, which have contributed much to the development of Alpine literature. At its last meeting Mr. Ed. Whymper and the meteorologist, Prof. Hamon, were elected Honorary Members.

THAT part of the Ala-tau Mountains which is situated north-east from Tashkent, at the sources of the Arys, Talas, and Pskem Rivers, and which remained until now quite unknown, is described in the *Izvestia* of the Russian Geographical Society (vol. xvii. fascicule 3) by Col. Ivanoff. It is a very complex system of mountains, from 10,000 to 16,000 feet high, covered with mighty glaciers. The upper clefts have still conserved a good deal of forests, and the high Alpine pasturages are the grazing ground for the numerous herds of Kirghizes, as well as for the great species of *Ovis*, common to Thian-Shan. Col. Ivanoff has found numerous proofs that formerly the glaciers had a greater extension than now, and that they formed in the valley of the Maydan-tal River a mighty glacier which descended as low as 7000 feet, but he did not discover traces of a general glaciation.

HERR ERNST MARNO gives, in the last fascicule of the *Memoirs* of the Geographical Society of Vienna (vol. xxiv. Nos. 6, 7, 8, and 9), an interesting description of his expedition for the de-

struction of the *setts* of the Nile, that is, of the great grass-islands which are formed during the inundations of the steppes watered by the Bahr-el-Gebel and the Bahr-el-Abiad. The accumulation of grass which is driven away during the inundations constitutes, as is known, wide grass-islands, or *setts*, which bar up the river, and, when not cut through for several years, gradually increase by fresh grass and slime, and soon constitute true floating islands twelve and fifteen feet thick, which soon reach even the bottom of the river. It is with the greatest difficulty that Marno's steamer cut passages through these islands and destroyed the smaller ones.

WE see with pleasure that the Austrian Tourists' Club, which numbers as many as 300 members, has begun to publish fortnightly a *Tourists' Newspaper*, richly illustrated, which has as contributors many well-known scientific writers.

IN the *Monatsschrift für den Orient* for September, Herr von Schweiger-Lerchenfeld has a long article full of valuable information on Tripolitania, *à propos* of recent doings in North Africa. There is also an interesting letter from Ernst Marno on the Sudan.

IN the *Bulletin* of the Antwerp Geographical Society (tome vi. 3^e fasc.) M. L. Delavaud has brought together a number of valuable notes on the climate of Africa, interesting both from a scientific and a practical point of view.

THE last number of the *Izvestia* of the Russian Geographical Society contains papers, by M. Maëff, on the roads leading from Karshi to the Amu-daria River, and on the valleys of Vaksh and Kafirnahan; by M. Ivanoff on the upper parts of the Talas Alatau, and a map showing M. Mikluho-Maclay's travels in the Melanesian Islands.

THE eighth volume of the *Memoirs* of the Russian Geographical Society, for the section of ethnography, contains several valuable papers on the middle parts of the valley of Zerafshan, on the basin of Lob-nor, on the valley of Ferghana, on the Bekdons Shahrisabs, on the journey of Jenkinson to Khiva in 1559, on the Khiku-nor, and on the customs of the Tartars of Kazan.

IN a pamphlet entitled "Geography" Messrs. Ramsey, Millett, and Hudson have reprinted, from the Kansas City *Review of Science and Industry*, an interesting collection of official documents relating to United States Arctic colonisation and exploration in 1881. There are now no less than six expeditions in progress under Government control, which are divisible into two classes, one comprising those sent out for purposes of exploration and scientific research and the other those whose object is of a humanitarian nature. To the former class belong the *Jeannette*, Lady Franklin Bay, and Point Barrow expeditions, while the latter includes the *Rodfars*, *Alliance*, and *Corwin*, all chiefly engaged in searching for the *Jeannette* and missing whale-ships.

The just published *Bulletin* of the Belgian Geographical Society includes a paper by Capt. Verstraete on the great lakes of inter-tropical Africa from the fifteenth to the nineteenth century. There are also maps of Borneo, the new northern frontier of Greece, &c., which exhibit considerable roughness of execution.

ECONOMICS AND STATISTICS, VIEWED FROM THE STANDPOINT OF THE PRELIMINARY SCIENCES¹

THE object of the present paper is to show the relation of the preliminary sciences to statistics and economics, and to attempt to make the transition from the former studies to the latter simple and attractive to the scientific man. This must evidently be done by constructing a classification of social knowledge avoiding all immediate reference to practice. That such a classification does not at present exist cannot be better evidenced than by Mr. Baden-Powell, who has kindly drawn my attention to the conclusion of his paper, read on the previous day, "On Protection in Young Communities," in which he states the difficulties he has encountered in many departments of his researches because of the different methods of classification adopted in otherwise excellent statistical records, and insists that "uniformity in the method of registering statistical facts is of the utmost importance to comparative investigations," so that

¹ Abstract of a paper read before Section F of the British Association, 1881, by P. Geddes, F.R.S.E.